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EXAMINER	
TIETJEN, MARINA ANNETTE	

ART UNIT	PAPER NUMBER
3753	

MAIL DATE	DELIVERY MODE
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/553,309	GRUMMON, DAVID S.	
	Examiner	Art Unit	
	MARINA TIETJEN	3753	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 January 2009*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17,19-32 and 34-38* is/are pending in the application.

4a) Of the above claim(s) *34-37* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17,19-32 and 38* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 January 2009* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Response to Amendment

1. This office action is responsive to the amendment filed on 01/16/2009. As directed by the amendment: claims 1, 17, 26, and 29 have been amended, claims 18 and 33 have been cancelled, and new claim 38 has been added. Thus, claims 1-17, 19-32, and 34-38 are presently pending in this application.

Response to Arguments

2. Applicant's arguments with respect to claims 1-17, 19-32, and 34-38 have been considered but are moot in view of the new ground(s) of rejection. The instant Office Action has been made FINAL.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claims 1, 10, 17, and 29 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

5. Claim 1 recites the limitation "cutting the polymer film in a plurality of directions to form a plurality of monolithic thin film actuators having generally the same size after the step of imparting strain" in lines 7-9. It is not clear what is meant by this limitation. Do the plurality of thin film actuators have generally the same size after cutting, does the

polymer film have generally the same size after the step of imparting strain, or do the plurality of thin film actuator have generally the same size after the step of imparting strain?

6. Claim 17 recites the limitation "cutting the shape memory alloy construction in a plurality of directions to form a plurality of monolithic thin film actuators having generally the same size after the step of conducting a post annealing process" in lines 10-12. Do the plurality of thin film actuators have generally the same size after cutting, does the polymer film have generally the same size after the step of conducting a post annealing process, or do the plurality of thin film actuator have generally the same size after the step of conducting a post annealing process?

7. Claim 29 recites the limitation "after –the-- step of etching the shape memory alloy film" in lines 8-9. There is insufficient antecedent basis for this limitation in the claim.

8. Claim 10 recites the limitation "layering portions of the film with a conductor". It is unclear if "the film" refers to the polymer film or the shape memory alloy film.

Claim Rejections - 35 USC § 103

9. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

10. Claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22, 23, 29-32, and 38 as far as they are definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958).

Krulevitch et al. disclose a method for producing a plurality of thin film actuators comprising:

sputter deposing a film of a shape memory alloy material onto the polyimide film (pg. 270, col. 2, 2nd paragraph) to form a shape memory alloy construction;

annealing the shape memory alloy construction (pg. 270, col. 1, 1st para.);

imparting a 2 to 8% strain (pg. 270, col. 1, 1st para.) to the shape memory alloy construction;

conducting a post straining process on the shape memory alloy construction (etching a pattern on the alloy film) after the step of imparting a 2 to 8% strain; and

cutting the polyimide film in a plurality of directions (etching the sacrificial polyimide layer, wherein the etching cuts away material in all directions of the polyimide film) (pg. 270, col. 2, 2nd para.) to form a plurality of monolithic thin film actuators (produces free-standing serpentine springs); and

wherein the post straining process on the shape memory alloy comprises of exposing the shape memory alloy layer to a photo resist mask and etching the shape memory alloy material (pg. 280, col. 1, 2nd para.) prior to cutting the polymer film into a plurality of actuators (patterning is done prior to cutting away the sacrificial polyimide film).

However, Krulevitch et al. does not disclose degassing a polyimide film in a vacuum, and is silent on whether the cutting of the polyimide film in a plurality of directions to form a plurality of monolithic thin film actuators occurs after the step of imparting a strain.

Choi et al. teach of degassing a polymer film in a vacuum for the purpose of cleaning the substrate of impurities (para. 0057) that could degrade the quality of the actuator.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Krulevitch's method to include degassing a polymer film in a vacuum, as taught by Choi et al., for the purpose of cleaning the substrate of impurities that could degrade the quality of the actuator. However, Choi does not disclose cutting the polymer film to form a plurality of thin film actuators after the step of imparting a strain.

Rivelli et al. teach the alloy film is strained (formed to its desired shape) and then annealed (para. 0033) in a manner known in the art, and further teaches the alloy film can be annealed prior to being cut (or released by etching) from a substrate (para. 0030), in a manner known in the art.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Krulevitch's method such that the cutting of the polyimide film in a plurality of directions to form a plurality of monolithic thin film actuators occurs after the step of imparting a strain, as taught by Rivelli et al., by

shaping and annealing the alloy film, and then releasing the alloy film from a substrate, in a manner that is known in the art.

Regarding claims 5, 6, 19, 20, 30, and 31, the Examiner takes Official Notice that imparting strain to a polymer film can be performed axially or biaxially. One of ordinary skill in the art would have found it obvious to impart strain on the SMA polyimide film in an axial or biaxial direction as suitable for the intended use as a matter of design choice.

11. Claims 4 and 21, as far as they are definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958), as applied to claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22, 23, 29-32, and 38 above, further in view of Johnson et al. (U.S. Pat. No. 5,619,177).

Krulevitch discloses the invention as essentially claimed, except for the TiNi film of shape memory alloy was selected from the group consisting of TiNiPd, TiNiAu, TiNiZr, TiNiHf, TiNiPt and combinations thereof.

Johnson et al. teaches of using TiNiPd as a shape memory alloy for an actuator since it can be easily deformed when cold, produces large stress forces, and has a shape recovery of several percent when heated through the transition temperature (col. 5, lines 57-64).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to further modify Krulevitch's method such that the shape memory alloy material be TiNiPd, as taught by Johnson et al., for the purpose of using a material with desirable attributes for creating an actuator, such as being easily deformed when cold, producing large stress forces, and having a shape recovery of several percent when heated through the transition temperature.

12. Claim 7, as far as it is definite, is rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958), as applied to claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22, 23, 29-32, and 38 above, further in view of Tanaka et al. (U.S. Pub. No. 2002/0112788).

Krulevitch discloses the invention as essentially claimed, except for the step of imparting a strain in a cyclic manner by heating and cooling under applied uniaxial or biaxial loading with the last cycle ending with strain applied in the fully martensitic condition.

Tanaka et al. teach the step of imparting a strain in a cyclic manner by heating and cooling under applied weight load (uniaxial or biaxial loading) with the last cycle ending with strain applied in the fully martensitic condition for the purpose of improving the deterioration rate of shape strain recovery of the actuator element (para. 0022).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Krulevitch's method such that the strain is done in

a cyclic manner by heating and cooling under applied weight load (uniaxial or biaxial loading) with the last cycle ending with strain applied in the fully martensitic condition, as taught by Tanaka et al., for the purpose of improving the deterioration rate of shape strain recovery of the actuator element.

13. Claims 10-12 and 14-16, as far as they are definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958), as applied to claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22, 23, 29-32, and 38 above, further in view of Sugihara et al. (U.S. Pub. No. 2003/0020502).

Krulevitch discloses the invention as essentially claimed, except for sputter coating a second layer of a conductor selected from the group consisting of Cu, Au, Ag, Ni, Cr and combinations thereof, wherein the conductor is between 1 and about 100 microns thick; or does not disclose that the second layer is a plating assist layer.

Sugihara et al. teaches of sputter coating a second layer of Cr onto a substrate for the purpose of providing a resistance element of a multilayered wiring substrate that has an impurity mixed in the conductor film from the sputtering process which results in a higher resistance value (para. 0083), and further teaches of a second layer of Cr as a plating assist layer for the purpose of enhancing the adhesion of the substrate to a wire (para. 0081).

It would have been obvious to one invention such that of ordinary skill in the art at the time the invention was made to further modify Krulevitch's method to include sputter coating a second layer of Cr onto a substrate, and further teaches of a second layer of Cr as a plating assist layer, as taught by Sugihara et al., for the purpose of providing a resistance element of a multilayered wiring substrate that has an impurity mixed in the conductor film from the sputtering process which results in a higher resistance value and for enhancing the adhesion of the substrate to the wire element.

Even though Sugihara does not directly disclose the conductor is between 1 and about 100 microns thick, Sugihara does disclose the resistance value of the Cr layer can be adjusted by the thickness of the layer (para. 0082).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to adjust the thickness of the Cr layer between 1 and 100 microns, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

14. Claim 24, as far as it is definite, is rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958), as applied to claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22, 23, 29-32, and 38 above, further in view of Ingram (U.S. Pat. No. 5,836,066).

Krulevitch discloses the invention as essentially claimed, except for the step of imparting strain to the polymer film comprises the steps of placing the shape memory alloy construction over a die, and applying differential pressure into the die to deform the shape memory alloy construction.

Ingram teaches the step of imparting strain to the polymer film comprises the steps of placing the shape memory alloy construction over a die 610 (Fig. 6a), and applying differential pressure (due to the curved shape of the die) into the die for the purpose of applying strain to the shape memory alloy construction without forming ripples therein (col. 7, lines 6-12).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Krulevitch's method such that the step of imparting strain to the polymer film comprises the steps of placing the shape memory alloy construction over a die, and applying differential pressure into the die, as taught by Ingram, for the purpose of applying strain to the shape memory alloy construction without forming ripples therein.

15. Claims 25-27, as far as they are definite, are rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958), further in view of Ingram (U.S. Pat. No. 5,836,066), as applied to claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22-24, 29-32, and 38 above, further in view of Palmaz et al. (U.S. Pub. No. 2003/0074503).

Krulevitch discloses the invention as essentially claimed, except for subjecting the shape memory alloy layer to ion irradiation to a depth of about one-half the thickness of the shape memory alloy layer, wherein subjecting the shape memory alloy layer to heavy ion irradiation is subjecting the shape memory alloy layer with at least one of argon or krypton to damage the crystal structures to a degree that reverse transformation to the austenite is prevented.

Palmaz et al. teach ion bombardment of the shape memory alloy using an inert gas, such as argon, xenon, nitrogen or neon, for the purpose of reducing void content by increasing the atomic packing density in the deposited material, wherein the reduced void content in the deposited material allows the mechanical properties of that deposited material to be similar to the bulk material properties (para. 0050).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Krulevitch's method to include subjecting the shape memory alloy layer to heavy ion irradiation is subjecting the shape memory alloy layer with at least one of argon or krypton, as taught by Palmaz et al., for the purpose of reducing void content by increasing the atomic packing density in the deposited material, wherein the reduced void content in the deposited material allows the mechanical properties of that deposited material to be similar to the bulk material properties.

Palmaz et al. do not specifically teach the ion irradiation is to a depth of about one-half the thickness of the shape memory alloy or that the damage to the crystal structures is to a degree that reverse transformation to the austenite is prevented.

However, it would have been obvious to one having ordinary skill in the art at the time the invention was made to subject the shape memory alloy layer to ion irradiation to a depth of about one-half the thickness of the shape memory alloy layer or to a degree that reverse transformation to the austenite is prevented, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only routine skill in the art. In re Aller, 105 USPQ 233.

16. Claim 28, as far as it is definite, is rejected under 35 U.S.C. 103(a) as being unpatentable over Krulevitch et al. (Thin Film Shape Memory Alloy Microactuators, 1996) in view of Choi et al. (U.S. Pub. No. 2003/0062254) further in view of Rivelli (U.S. Pub. No. 20020007958), further in view of Ingram (U.S. Pat. No. 5,836,066), further in view of Palmaz et al. (U.S. Pub. No. 2003/0074503), as applied to claims 1-3, 5, 6, 8, 9, 13, 17, 19, 20, 22-27, 29-32, and 38 above, further in view of Kornrumpf et al. (U.S. Pat. No. 6,655,011).

Krulevitch discloses the invention as essentially claimed, except for further comprising coupling two thin film actuators together to form a blister actuator.

Kornrumpf et al. teaches coupling two thin film actuators together to form a blister actuator for the purpose of providing an actuator capable of being manufactured at a micro level and to provide an integral switching mechanism within the high density interconnect circuit environment (col. 1, lines 29-32; col. 2, lines 43-44).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to further modify Krulevitch's method to include coupling two thin film actuators together to form a blister actuator, as taught by Kornrumpf et al., for the purpose of providing an actuator capable of being manufactured at a micro level and to provide an integral switching mechanism within the high density interconnect circuit environment.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to MARINA TIETJEN whose telephone number is (571)

270-5422. The examiner can normally be reached on Mon-Thurs, 9:30AM-5:00PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, ROBIN EVANS can be reached on (571) 272-4777. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/M. T./
Examiner, Art Unit 3753

/John K. Fristoe Jr./
Primary Examiner, Art Unit 3753